

SEROLOGIC SURVEY OF HARBOR SEAL POPULATIONS FOR EVIDENCE OF EXPOSURE TO SELECTED DISEASE AGENTS

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INTRODUCTION

During the past 25 years, an increasing number of infectious diseases have been detected in marine mammal populations around the world. In large measure, this has been a simple matter of more attention being focused on these species. The primary objective of the current serologic survey was to provide data regarding exposure rates to selected disease agents for harbor seal populations from selected areas off the Alaska coast.

METHODS

Blood samples were collected by personnel from several agencies and universities during 1975-1999. Sera were harvested and stored at -20 to -50 °C for up to 20 years until the time of testing. Information regarding test procedures is presented in Table 1. Samples that met or exceeded threshold titers were considered indicative of prior natural exposure. These samples will be referred to as “positive.” Samples that did not meet threshold titers will be referred to as “negative.”

RESULTS AND DISCUSSION

BRUCELLA SPP.

The overall antibody prevalence of 27% for all geographic areas combined (Table 2) was less than the 45% previously reported for harbor seals in these areas (Sheffield *et al.* 1997). The general time frame of the 2 surveys was similar. Therefore, we are unaware of any biologic factors that could explain the apparent discrepancy. There was little variability among location-specific prevalences. Sample sizes were too small and scattered to calculate meaningful chronologic patterns of prevalence.

Brucella spp. is found worldwide in a wide variety of host species. Infection can result in debilitating arthritis. Infection can also cause pregnant females to abort. Evidence of exposure in marine mammals is a relatively recent discovery. Effects of infection in these species are less well understood.

TOXOPLASMA GONDII

Results are presented in Table 3. Location-specific prevalences are relatively consistent and are in general agreement to data presented previously (Sheffield *et al.* 1997). Sample sizes were too small and scattered to calculate chronological patterns of antibody prevalence. This agent has apparently reached equilibrium in harbor seal populations in Alaska. Impact(s) of exposure on either individual animals or populations remains unknown.

T. gondii is found worldwide in a wide variety of host species. Infection may localize in heart, brain, liver, lung, lymph nodes or stomach (Haebler and Moeller 1993). This organism has been isolated from a harbor seal pup captured near Cold Bay, Alaska (Van Pelt and Dietrich 1973).

LEPTOSPIRA INTERROGANS

Results are presented in Table 4. Antibody prevalence for the 5 serovars of *Leptospira interrogans* was very low. One sample from 1993 had the minimal positive titer (100) for serovars *canicola*. One sample from 1994 had a titer of 100 for serovar *hardjo*. In similar cases with other species, results of this nature are often considered to be “false positives.” Apparently, these agents represented little health threat to the selected Alaska harbor seal populations during the period of this survey.

Leptospire are spirochete bacteria. They are found worldwide in a wide variety of host species. Infection localizes in kidneys. Infection can be acute and accompany clinical disease. It can also be chronic with no apparent negative health impacts.

PHOCINE DISTEMPER VIRUS

Phocine distemper virus (PDV) infection in pinnipeds can cause fever, nasal discharge, cutaneous lesions, gastrointestinal distress, and central nervous system effects (Visser *et al.* 1991). Epizootics in seals were found at Lake Baikal during 1987 and northern European waters during 1988 (Visser *et al.* 1990). Exposure has also been documented in harbor seals from waters of eastern Canada (Ross *et al.* 1992) and New York (Duignan *et al.* 1993).

Results of the current survey are presented in Table 5. Antibody prevalence for PDV was very low. Only 2 samples were positive. One had a titer of 12, and the other had a titer of 24. In similar cases with other host species, these results might be considered false positives. Apparently, exposure of harbor seal populations in waters off Alaska to PDV has been extremely limited. This agent is not perceived to represent a threat to the health of harbor seals in these areas at this time.

PHOCID HERPESVIRUS

Results are presented in Table 6. Antibody prevalence was very high for all years, all locations, all age classes, and both sexes. These results concur with previous surveys of marine mammals from Alaska waters (Sheffield *et al.* 1997; Zarnke *et al.* 1997). No clinical cases of disease have been reported. Apparently, this virus is not highly pathogenic for marine mammals in this area under normal circumstances.

Phocid herpesvirus-1 was first isolated from harbor seal pups in a sanctuary in the Netherlands (Borst *et al.* 1986). Clinical signs included fever, nasal discharge, vomiting and

diarrhea. Subsequent studies revealed that pinnipeds throughout the world have been exposed to herpesviruses (Vedder *et al.* 1987; Lowenstine *et al.* 1992).

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Table 1. Location, method, and threshold titer for serologic tests conducted on Alaskan harbor seal samples.

Disease agent	Laboratory	Method	Threshold
<i>Leptospira interrogans</i>	Wyoming State Veterinary Lab	Microscopic agglutination test	100
<i>Toxoplasma gondii</i>	US Department of Agriculture; Beltsville, MD	Modified agglutination test	25
<i>Brucella</i> spp.	Central Veterinary Lab; United Kingdom	Competitive and indirect enzyme-linked immunosorbent assay	30
Phocine distemper virus	Oklahoma State University	Serum neutralization	4
Phocid herpesvirus	Oklahoma State University	Serum neutralization	4

Table 2. Serum antibody prevalence of *Brucella* spp. in harbor seals (*Phoca vitulina richardsi*) from selected Alaska waters, 1978–1995.

Location	1978	1985	1989	1993	1994	1995	Total
Kodiak	0/9 ^a		1/6	0/4			1/19 (5%)
Bering Sea		8/22					8/22 (36%)
Prince William Sound			1/9	2/11	8/29	11/25	22/74 (30%)
Southeast Alaska				4/14			4/14 (29%)
COMBINED							35/129 (27%)

^a Number positive/number tested.Table 3. Serum antibody prevalence of *Toxoplasma gondii* in harbor seals (*Phoca vitulina richardsi*) from Alaska waters, 1978–1995.

Location	1978	1985	1989	1993	1994	1995	Total
Kodiak	2/9 ^a		1/6	1/4			4/19 (21%)
Bering Sea		5/20					5/20 (25%)
Prince William Sound			0/9	2/11	2/29	2/26	6/75 (8%)
Southeast Alaska				2/14			2/14 (14%)
COMBINED							17/128 (13%)

^a Number positive/number tested.

Table 4. Serum antibody prevalence of *Leptospira interrogans* in harbor seals (*Phoca vitulina richardsi*) from selected Alaska waters, 1975–1996.

Location	1975	1976	1977	1978	1979	1985	1989	1990	1991	1992	1993	1994	1995	1996	Total
Prince William Sound	0/6 ^a	0/10	0/7				0/18	0/9	0/2	0/7	1/22	1/37	0/48	0/64	2/230 (1%)
Kodiak		0/44	0/27	0/27							0/4		0/16	0/16	0/134 (0%)
Kenai			0/5	0/4											0/9 (0%)
Alaska Peninsula				0/4		0/24									0/28 (0%)
Pribilof Islands					0/16										0/16 (0%)
Southeast Alaska											0/18	0/25	0/19	0/17	0/79 (0%)

^a Number positive/number tested.

Table 5. Serum antibody prevalence of *Phocine distemper virus* in harbor seals (*Phoca vitulina richardsi*) from selected Alaska waters, 1975–1999.

Location	1975	1976	1977	1978	1979	1985	1989	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Prince William Sound	0/3 ^a						1/8	0/2	0/2	0/7	0/1	0/3	0/4	0/9	0/26	0/28	1/93 (1%)
Icy Bay		0/6															0/6 (0%)
Kenai		0/3	0/4														0/7 (0%)
Kodiak		0/5	0/3	1/4							0/6	0/3		0/12			1/33 (3%)
Pribilof Islands					0/8												0/8 (0%)
Alaska Peninsula				0/4		0/6											0/10 (0%)
Southeast Alaska										0/4	0/2	0/3	0/1				0/10 (0%)

^a Number positive/number tested.

Table 6. Serum antibody prevalence of Phocid herpesvirus-1 in harbor seals (*Phoca vitulina richardsi*) from selected Alaska waters, 1975–1999.

Location	1975	1976	1977	1978	1979	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Prince William Sound	4/7 ^a						18/18	5/9	7/8	6/8	14/15	9/11	10/10	8/8	15/15	30/30	29/30	155/169 (92%)
Icy Bay		4/7																4/7 (57%)
Kenai			11/11															12/13 (92%)
Kodiak		8/9	8/8	10/10								9/9	5/7	4/5	12/13			56/61 (92%)
Lower Cook Inlet				7/7														7/7 (100%)
Pribilof Islands					15/15													15/15 (100%)
Alaska Peninsula						19/22												19/22 (86%)
Southeast Alaska											10/14	9/9	5/6	6/6				30/35 (86%)

^a Number positive/number tested.